House Committee on Energy and Commerce
9 March 2005
The Implementation of GEOSS: A Review of the All-Hazards Warning System and its Benefits to Public Health, Energy and the Environment
Gregory E. Glass

SUMMARY

The goal of public health is to prevent rather than treat diseases in populations of people. This requires identifying risk factors, many of which are related to environmental exposures. There has been a long history of successfully identifying risk factors for both environmental and infectious diseases that are influenced by the environment. These studies have been used to design interventions that reduce the burden of disease. This approach has been especially successful where individual behaviors or occupational exposures are responsible for disease.

However, many of our current public health problems are influenced by conditions that are more ubiquitous and frequently more subtle in their effects. To achieve the stated goal of health through prevention, public health practitioners therefore need to know what, where and when leading environmental conditions indicate that there are increased risks for these diseases and the environmental indicators must be monitored sufficiently frequently and over broad enough regions that they produce meaningful results for our citizens. GEOSS represents an important component of a public health program that is needed to make prevention a reality. The system captures many of the key environmental variables at appropriate spatial and temporal resolutions to implement environmental surveillance for many of the important infectious and environmental diseases affecting the country today. However, the data generated from GEOSS must be appropriately integrated with health outcome measures to create a fully functional public health warning system.

I would like to thank the committee and the chair for this opportunity to meet with you today concerning the implementation of GEOSS as part of a public health warning system. My name is Gregory Glass and I am a professor in the department of Molecular Microbiology and Immunology at the Johns Hopkins Bloomberg School of Public Health where I work on infectious diseases, though I am here today representing myself.

The stated goal of public health is to prevent the occurrence and emergence of diseases in human populations by identifying the factors responsible for causing diseases and designing strategies to mitigate their effects through education of the public and developing interventions to reduce people's exposures to these risk factors. Public health, therefore, is distinct from modern medicine in that its goal is prevention rather than treatment of diseased individuals, though there are many areas such as the creation of vaccines and more recent advances in bioinformatics, genomics and proteomics, where the two fields benefit greatly from one another.

Public health has had a long history of successfully identifying environmental conditions that are linked with health outcomes. The association between human exposures to chemicals either in the workplace or as part of daily life and health effects provide many clear examples of this approach that are amenable to behavioral or regulatory intervention. Similarly with infectious agents, such as Lyme disease bacteria or West Nile virus, understanding the environmental factors that favor the animal vectors of these pathogens allow us to create rational, targeted, interventions that can improve the health of the public.

The approach of linking of environmental conditions to human health and then acting can be so successful that we free the population from risk. For example, early in

the last century citizens with sufficient resources would leave Washington DC, Baltimore and Philadelphia (as well as other Eastern cities) during the summer to escape both the heat and the mosquito-borne plagues of the summer. Studies followed by interventions such as environmental modification led to the control Yellow Fever, and malaria in this country and were so successful that we no longer think of these diseases as having occurred here.

What I believe has limited our ability to use the public health approach to deal with many of the current diseases that are influenced by the environment has been our inability to extend the health information we gather at a local scale (as part of our traditional public health data) to regional, national or international levels. To do this we need to monitor environmental conditions repeatedly over a geographic region that matters to the citizens of this country and provide that information before conditions become so severe that we are dealing with a health crisis.

During the past 15-20 years we have gained experience in linking diseases with leading environmental indicators that can provide important clues to conditions that indicate impending outbreaks. What we have discovered is that in many situations it is how the environment changes over days and weeks that provide important clues to disease risk. A major goal of GEOSS is to integrate and incorporate many Earth observing systems that repeatedly monitor conditions around the globe. This is a critical aspect to any strategy that will attempt to monitor changes in the environment. The likelihood that we can capture just the right time and place leading up to a disease emergence with a single environmental monitoring is slim and none. By contrast, we have found that data acquisition strategies exemplified by Landsat allowed us to

retrospectively identify the environmental conditions that led to the outbreak of hantavirus pulmonary syndrome in the U.S. Southwest in the early 1990's and allows us to now anticipate when conditions favor new outbreaks.

By intending to integrate and coordinate sustained Earth observations, GEOSS provides an important component of the system that can move public health from a descriptive and reactive practice to a predictive and forecasting one that could truly mitigate against disease risks for the public in much the same we that we now expect weather forecasters will provide us with sufficient warning from oncoming storm events.

I would note that GEOSS, alone, will not generate a product that will give us 'the West Nile virus forecast for the coming week'. To function in the role of forecasting times and places of increased disease risk it will be necessary to establish the linkage between leading environmental conditions that predict health events and the health events themselves. This means that the second, key component of the system is the involvement and commitment from those members of the health community who hold access to the health data at a very high resolution so we can use historical information to establish the environment-health relationships. This is a challenge for two reasons. First, it requires the commitment from the public health community that this is a strategy that should be pursued. Second, the personal health information that they hold is rightly a very sensitive issue affecting many individuals. Particularly with the tremendous power of distributed data networks to disseminate information many health professionals remain challenged to identify strategies that will use this information to help the community while safeguarding the privacy of individuals. Finally, there is a critical need to incorporate these two sets of information in appropriate ways so that we can have the highest levels

of confidence in the interpretation of the results. Again, these approaches are relatively straightforward but are only rarely applied at the scale we are discussing today.

I do not doubt there are many challenges that face us in developing an environmental monitoring system that can improve human health but I also believe the challenge is worth the effort. We require little if any major advances in technology or methods to make progress that will reward our citizens. We do require a vision that will merge these important fields together. GEOSS appears to represent an approach that will create a system to achieve these goals.